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THE SPIRIT OF CO-OPERATION.

The spirit of co-operation should pervade the minds and interests of the agricultural community of British Guiana to a far greater extent than it does at the present day. Without doubt some advance has been made during more recent times but it has been slow in coming and is not in keeping with similar forms of progress accomplished elsewhere in the world.

There are a number of cases in point but the following may be chosen as being typical instances of where co-operation should be an essential.

All forms of stock rearing and milk production in British Guiana appear to be performed in a haphazard and perfunctory manner. A recent inquiry into the milk supply of the neigbouring island of Trinidad (to which we hope to make further reference in our next

issue) among other points revealed the fact that much of the poor quality milk was, broadly speaking, directly due to the ignorance of the dairymen themselves as to methods of handling their stock. This could not exist if co-operation existed and knowledge as to proper methods thus disseminated.

The same conditions exist here and co-operation is almost totally non-existent. A parallel instance occurs with the rearing of our cattle, sheep, pigs and other stock.

In this number we reproduce an article relative to the cost of rice production. That co-operation among rice growers is almost exceptional, especially among the East Indian community, is well instanced by the concluding sentence of this article: "none of these statements take into account either the costs of supervision or the interest on the constant expenditure per acre The former is, of course, very variable in its incident whilst the latter is largely controlled by whether the padi-grower employs his own capital, borrows from a loan bank or assists in supporting a local usurer and profiteer."

The outlook is by no means gloomy however. We have in our midst numerous Farming and Agricultural Associations, both extant and prospective, equipped with energetic Presidents and Secretaries. While the recently established British Guiana Sugar Planters Experimental Stations Committee indicates that the members of the senior agricultural industry are fully alive to the benefits which accrue from a co-operative spirit.

MEMORANDUM ON THE COST OF THE CULTIVATION OF RICE.

By the Director of Science and Agriculture and R. Ward, Superintendent, Botanic Gardens and Experimental Stations.

During the period 1913 to 1920, both years inclusive, padi was cultivated at the Botanic Gardens and detailed records of the cost of so doing kept. To get a relative insight into the actual costs of producing a bag of 140 lbs. of padi it is necessary to add to the actual expenditure the actual rental value of the land under rice. The costs of supervision and the interest on capital involved should also be included in the calculations, but it is not possible for this to be done in the case of the Botanic Gardens.

The records show that the costs of production of padi differed but little between the years 1913 and 1914; 1915 and 1916; and 1917 and 1918; and hence the mean prices paid for labour and supplies and the crops yielded during these periods are shown in the following tables. The records given for the years 1913 and 1914 may safely be taken as representing the pre-war costs of production of padi at the Botanic Gardens.

For this comparative statement we have utilised only the average results of the large scale experimental cultivations which occupy above 9 acres and have not included in them any results obtained from individual small plots which of course are subject to very great variation.

The yields of padi show a continuous decrease from 1913-1914 to 1920. These decreases may be in part due to less favourable climatic conditions during the later years but probably to a much greater extent to the gradual deterioration of the soil through the long-continued intensive cultivation of rice upon it. The rainfall conditions affecting the yields of rice have been as follows:—

Mean Rainfall in inches and yields of padi in bags of 140 lbs per acre.

	1913-1914	1915-1916	1917-1918	1919	1920
April to July inclusive (period of growth)	33.5	36.9	31.9	49.0	24.3
August to October inclusive (period of maturation)	14.2	10.2	10.6	7.9	9 6
Mean yield in bags per acre	39.0	32.5	30.8	27.1	26.

In the following table the rates and costs of production are shown :—

	1913 & 1914		1915 & 1916		1917 & 1918		1919		1920	
	Rates.	Costs.	Rates.	Costs.	Rates.	Costs.	Rates.	Costs.	Rates.	Costs.
Rent of land per annum per acre ...	$10.00	$10.00	$10.00	$10.00	[$10.00]	$10.00	$12.00	$12.00	$12.00	$12.00
Water Supply	.25	.25	.25	.25	.25	.25	.25	.25	.25	.25
Drainage	.78	.78	.78	.78	.78	.78	.78	.78	.78	.78
Cost of seed padi, 60 lbs.	1½ per lb.	.90	1½ per lb.	.90	.03 per lb.	1.80	.03 per lb.	1.80	.03 per lb.	1.80
Preparing beds for sowing seeds, 2 men...	.36 a day	.72	.36 a day	.72	.48 a day	.96	.75 a day	1.50	.75 a day	1.50
Weeding, 300 rods	1½ per rod	4.50	.02 per rod	6.00	.02 per rod	6.00	.02 per rod	6.00	.02 per rod	9.00
Forking ,, ...	2¼ per rod	6.75	.03 per rod	9.00	.03 per rod	9.00	.03 per rod	9.00	3½ per rod	10.50
Chipping and levelling, 300 rods ...	1½ per rod	4.50	.02 per rod	6.00	.02 per rod	6.00	.02 per rod	6.00	.03 per rod	9.00
Pulling out grass, weeds, etc., 2 women...	.20 a day	.40	.20 a day	.40	.36 a day	.72	.40 a day	.80	.60 a day	1.20
Pulling out seedlings, 2 men	.36 a day	.72	.36 a day	.72	.48 a day	.96	.60 a day	1.20	.72 a day	1.44
Planting seedlings, 8 women	.20 a day	1 60	.20 a day	1.60	.36 a day	2.88	.40 a day	3.20	.60 a day	4.80
Supplying seedlings 4 ,, ...	.20 a day	.80	.20 a day	.80	.36 a day	1.44	.40 a day	1.60	.60 a day	2.40
Weeding 300 rods	1½ per rod	4.50	.02 per rod	6.00	.02 per rod	6.00	.03 per rod	9.00	3½ per rod	10.50
Cultivation expenses.		$36.42		$43.17		$46.79		$53.13		$65.17

	1913 & 1914		1915 & 1916		1917 & 1918		1919		1920	
	Rates.	Costs.	Rates.	Costs.	Rates.	Costs.	Rates.	Costs.	Rates.	Costs.
Reaping.										
Cutting carrying, etc.,										
12 women	.20 a day	$2.40	20 a day	(10w) $2.00	.36 a day	(10) $3.60	.40 a day	(9) $3.60	.60 a day	(9) $5.40
Beating out grain, 12 men	.36 a day	1.32	.36 a day	(10) 3.60	.48 a day	(10) 4.80	.60 a day	(9) 5.40	.72 a day	(9) 6.48
Winnowing grain, 3 men...	.36 a day	1.08	.36 a day	1.08	.48 a day	(2) .96	.60 a day	(2) 1 20	.72 a day	(2) 1.44
,, ,, 2 women..	.20 a day	.40	.20 a day	(1) .20	.36 a day	(2) .72	.40 a day	(2) .80	.60 a day	(2) 1.20
Cost of bags	.16 per bag	6.24	.16 per bag	5.20	32 per bag	9.94	.32 per bag	8.64	.40 per bag	10.40
Sewing twine, ½lb ...	.32 per lb	.16	.48 per lb.	.24	.56 per lb	.28	.72 per lb.	.36	.72 per lb.	.36
Needles, 2	.02 each	.04	.02 each	.04	[illegible] each	.06	05 each	.10	.05 each	.10
		$14 61		$12.36		$20.36		$20.10		$25.38
Total per acre		51.06		55.53		67.15		73 23		90.55
Per bag		1.30		1 71		2.18		2 70		3.48

The costs per acre of production of padi are divisible into (a) constant, not dependant on yield, and (b) varying dependant on yield per acre and hence best expressed as costs per bag. These were :

	1913-14	1915-16	1917-18	1919	1920
(a) Constant (per acre)	$36.42	$43.17	$46.79	$53.13	$65.17
(b) Varying (per bag)	.37½	.38½	.66	.74	.97

The yields on various sections of the Experimental Fields and with different strains of padi in each yield have varied greatly from 45 bags of padi per acre as a maximum to 12 bags the minimum. The costs of production of a bag of padi in the various years as governed by the yields per acre were as follows :—

Yield Bags per acre.	1913-14	1915-16	1917-18	1919	1920
			Costs per bag of Padi.		
45	$1.17	$1.34	$1.74	$1.92	$2.47
40	1.28	1.46	1.83	2.07	2.60
36	1.39	1.58	1.96	2.21	2.78
32	1.51	1.73	2.12	2.40	3.01
28	1.67	1.92	2.34	2.63	3.30
24	1.89	2.18	2.61	2.95	3.69
20	2.19	2.54	3.00	3.40	4.23
16	2.65	3.08	3.58	4.06	5.04
12	3.41	3.98	4.56	5.17	6.40

During the period dealt with in this memorandum the average yield over the whole area under rice in the Colony and the estimated average costs of production per bag of padi have been :—

Period	Average yield bags per acre.	Estimated average costs per bag of padi.
1913-1914	21.2	$2.11
1915-1916	19.7	3.03
1917	19.1	3.19
1918	8.5	6.16
1919	15.5	4.20
1920	16. (estimated)	5.04

As a check on the costs of production of padi at the Botanic Gardens, the costs of production by certain of the Garden's employees cultivating rice for themselves on lands rented from Plantation Belair and using their own labour as well as hired labour have been determined.

Their average crops have been from about 19 to 23 bags per acre, and the costs have been approximately :—

Year.			
1917 & 1918	...	...	$2.60
1919 ...	...	...	3.30
1920 ...	...	...	3.70

The above results may be summarised that with high yields of say 28 bags of padi per acre the costs of production have increased, from in round figures, $1.70 in pre-war years to $3.30 in 1920; with good yields of say, 22 to 24 bags per acre from about $2.00 per bag to about $3.60 per bag; and with average yields of 18 bags per acre from $2.40 to $4.60.

Average yields of less than 16 bags of padi per acre obtained on land cultivated by hired labour cannot be regarded as commercially successful either in pre-war years or during recent years.

The above data are applicable only to the growth of padi on land already laid out for rice cultivation. Our experience at the Botanic Gardens in 1920 in cultivating rice on lands not hitherto used for its cultivation indicated that at the present high price of labour it is no longer a business proposition to lay out new land for rice-planting unless a yield of at least 25 bags per acre be assured and the selling price of rice be not less than $11.50 per bag.

None of these statements take into account either the costs of supervision or the interest on the constant expenditure per acre. The former is, of course, very variable in its incident, whilst the latter is largely controlled by whether the padi-grower employs his own capital, borrows from a loan bank, or assists in supporting a local usurer and profiteer.

NOTES ON A COLLECTION OF PRESERVED DRY FRUITS AND SEEDS.—(*Contd.*)

By J. F. Waby.

Cynometra trinitensis, as its name denotes, is native to Trinidad. Specimens the dry fruit. This is a rusty brown ball one inch or more in diameter, one-seeded, indehiscent, covered with a woody case one 16th inch thick, with a decided ridge around the centre, the seed filling the entire case, formed of 2 hard nut-like cotyledons; these on being moistened germinate, bursting open the case. Inflorescent in axillary fascicles, one inch or more across; flowers tiny, pure white, crowed together, looking like an immense white catkin 12-15 inches long: every terminal branch covered with flowers, making the tree look like an enormous snowball. Foliage twin-leaved, similar to that of Hymenaea, entire, oblong, thick, leathery, 3-3½ inches long, 1¾-2 inches wide, unequal sided, inner side almost straight, narrow side ½ inches wide, broad side 1½ inches wide, dark green above, pale green beneath, midrib prominent, veins irregular; petiole short. The young foliage as it springs is of a delicate flimsy texture, quite silk-like, making one think the tree is in bloom; this in a week or so becomes quite tense and green. As an ornamental tree it is quite conspicuous; the stem of a pale silver grey, regular. The general form of the tree a closely packed pyramid. Specimens Trinidad.

"Trinidad Purple-Heart," *Peltogyne porphyrocardia*. Specimens, the dry fruits, and heart-wood. Fruit a one-seeded, flat, roundish legume, 1¼ inches long, 1 inch wide, ¼ inch thick, almost straight on one side, rounded top and other side forming a blunt nose; indehiscent, swelling and splitting on becoming damp for germination. Inflorescence terminal and axillary in short panicles; flowers small, white, almost sessile. Foliage in twin pairs, each pair on alternate sides of branches,—stalk but ½ inch long, smooth, tense, leathery, oblong, pointed, 4-4½ inches long, 2-2½ inches wide, dark green above, glabrous

beneath, midrib prominent, veins all very fine, a few
serrations on edges. All branches short, angular and
brittle, grey or marbled. The stem of the tree is large,
grey barked; the centre or heart-wood comprises the
greater bulk of the stem, is of a hard nature and of a deep
purple colour. Specimens Trinidad.

"The Job's Tear." *Coix lachryma Jobi.* Intro-
duced from India and naturalized in the West-Indies. A
succulent grass growing to various heights and dimen-
sion according to the richness of the soil in which it is
planted. Specimens are the pearly grey fruits which are
egg-shaped in the general kind seen. Another shape
almost round, not very common, was obtained from Bar
bados as I was on my way to Canada. My first sight o
Job's Tears was in the South Kensington Museum
many years ago, long before I first left England. Thes
were very much larger than any I have seen since quit
yellow with age and of the round type. The stem
measure $\frac{1}{4}$ inch or more in diameter tapering towards th
summit. The joints are from 3-4 inches long, branchin
on alternate sides from a leaf-sheath; the main leav
vary from 9-11 inches long or more and $1\frac{1}{2}$—$1\frac{3}{4}$ inch
wide, acuminate; secondary leaves smaller and narrowe
midrib whitish, sunken, veins all very fine and smoo
Branches 8-9 inches long, secondary branches eman
from those producing the well known Job's tears, th
consist of a egg-shaped or roundish fruit, $\frac{1}{4}$ inch
diameter with the "tear" hanging like an "Oat," th
are at first green, then black, and lastly grey, ha
smooth.

The plant might have been expected to yield a foo
for Cattle, but evidently this is not the case, a
Demerara, where it is growing luxuriantly as a weed
the roadsides, more particularly up in the Peter's
district, it is only cut down as a weed, and the s
collected for ornamental work as beads. It is an ex
ingly ornamental grass when in full bearing. Neck

are made of the seeds (fruits) and are very much appreciated, particularly in the States and Canada. Basket work is also made by threading them on thin wire. There is no trouble whatever in piercing them as a needle or fine wire goes straight through. There is a peculiarity about their germination. In giving my lectures to the school-masters in Georgetown, it was necessary to find some grain germinating similar to that of "Barley," and by accident I found the Job's tear seed germinated in the same manner. If the seed was laid on the surface of the ground the radicle portion branched at once and the plumule grew straight upwards, but if the seed were embedded in the ground some distance, the plumule would rise to the surface of the ground like a fine piece of wire and form the base of its stem and stool on the top of it.

"Adlay"—*Coix lachryma Jobi.* This is another variety sent to the Trinidad Department of Agriculture from the Imperial Department of Agricultural in Barbados last year, with a note of introduction from Java where it is grown. "Being grown in Java to a slight "extent for making native beer. The grains may be "eaten like rice or ground into flour and used as wheat. "The kernels easily separate from the husks." Stems 3-3 feet 6 inches high, slender, ⅝ inch diameter, joints 4-6 inches long, purplish beneath the sheathing leaf-bases. Foliage 2 feet long, acuminate, 1½ inches wide, white midrib. Upper 12 inches branched, bearing the inflorescents in short 3 inch double on treble panicles, with small fruits on slender pendant stalks, one or two or more on each with the "tears" an inch long at the points, the fruits purplish brown, sphaeroidal, fluted, ⅜ inch diameter, the cases breaking away easily. The stools so far have very few stems, but these may produce more in richer ground. Otherwise the crop of fruits would scarcely be worth growing for.

"Ironwood" *Mesua ferrea* introduced from the East Indies. Specimens the hard-shell fruit. Fruit

$1\frac{1}{8}$ inches long (pointed) 1 inch by $\frac{7}{8}$ inch wide, hard brown shell, dehiscing in 2 valves which split again, and which turn into furrows and form corners. The fruit is exactly like the seed of the molucca or candle nut, though not so hard. The skin closely corrugated, fitting into the Calyx of 4 sepals, each sepal clasping a corner of the fruit, cupped, two—1 inch long, $\frac{3}{4}$ inch wide, and the others (the outer ones) $\frac{1}{2}$ inch wide, and $\frac{5}{8}$ inch long. Inside—when dehisced smooth, pale satiny, containing one brown seed, hard, shaped like the shell of the fruit, with 4 sharp corners $\frac{3}{4}$ inch x $\frac{5}{8}$ inch x $\frac{3}{4}$ inch. Inflorescents terminal in the axils of the last 2·3 pairs of leaves, one flower to each pair alternately. Flower buds oblong with a calyx of 4 reddish—purple or crimson sepals, opening out into concave cups. The corolla of 4 white petals $1\frac{1}{2}$ inches long, $1\frac{1}{2}$ inches wide, narrowing to the centre, edges flimsy, of crêpe-like texture. The centre with innumerable dark golden stamens $\frac{3}{8}$ inch long, filiforme; ovary whitish $\frac{5}{16}$ inch diameter and as high, angular pistil $\frac{1}{2}$ inch long. Foliage in pairs one inch or more apart, petiole $\frac{1}{4}$ inch long; leaves lanceolate acuminate, 4 inches long, barely an inch wide, blade surface pale green, smooth, the midrib whitish, the back of the leaves quite silvery. The sweet-scented flowers are sold in the Indian bazaars by the name of Nagksun, and are as much esteemed as orange flowers are with us. The tree is a tall well furnished pyramid of short brittle pendant branches, forming very dense; the young foliage opening out a bright pink; and the flowers all produced on the outside making a beautiful show. Specimens obtained in the Royal Botanic Gardens, Trinidad.

Momordica cochinchinensis, introduced from the East; a relative of the "Karasla" used by the East Indians in their curries. Specimens, the large dark brown seeds. These are hard-woody. Shield-shaped dark brown, $1\frac{1}{4}$ inches long, $1\frac{1}{8}$ inches wide, $\frac{1}{4}$ inch thick, with short blunt points all round as if they had been

bitten or gnawed, the base of the shield being the lowest point. One of the most peculiar seeds one sees. The plant is a rampant climber with strong thick succulent ribbed stems. Foliage 4-5 inches apart, palmate, 5 lobed, the centre cut deeply and wide, blunt; the blade 6 inches long, 5-6 inches wide, outer segments $1\frac{3}{4}$ inches long, pointed, lower ones short, auriculate, central rib running from petiole through each, main veins wide apart, dark green above, pale beneath, 2 glands at base, one on each side of the petiole. Petiole $3\frac{1}{2}$ inches long, stout. Inflorescents solitary, large axillary. Flowers monœcious cream coloured, male flowers corolla 4 inches across of 5 foliaceus petals, membranous, ribbed, folding $3\frac{1}{2}$ inches long $1\frac{1}{4}$ inches wide, base of each cupped, the whole base $1\frac{1}{2}$ inches wide, each cup with a dark purplish plash. The staminate organs $\frac{1}{2}$ inch high with yellow anfractuose filaments. Flower stalk $\frac{1}{2}$ inch long, with a brown flattish calyx of 5 points an inch wide. The female flowers are similar in colour, form and size, distinctly marked with veins on the petals, and dark purplish spots at the base inside. The calyx green, $\frac{1}{2}$ inch wide, of 5 filiform extended sepals. The gynaecium of 3 lobes, sub-divided, $\frac{1}{2}$ inch high and rather less wide cream coloured Ovary dark green 1 inch long, $\frac{5}{8}$ inch wide, with closely set short spines; peduncle $3\frac{1}{2}$ inches long, $\frac{1}{8}$ inch thick. The fruit solitary,— hanging by a peduncle which has increased in size since the flower was impregnatad, 6 inches long, $\frac{5}{8}$ inch thick, 7 inches by 5 inches, elliptical closely echinate with short greenish spines, ripening a rosy-red, the shoulders coloured like a greenish calyx, and the point greenish for some time, eventually softening and losing the green colouring; it is succulent, indehiscent. On being cut open, the skin is tense adhering to a yellow putty-like matter $\frac{1}{2}$ inch thick, the base and top thicker, forming an elliptical cavity in which are arranged serially 5 rows of seeds covered with a dark crimson tense putumen, like that of arnatto, the centre to which the seeds are attached being of a dark crimson soft nature. The whole inside of the cavity is stained

dark crimson and bearing marks of each separate seed. The crimson covering of the seeds is easily detached though it may stain the fingers as in the case of the arnatto it is about $\frac{3}{16}$ inch thick, the lower end of the shield is attached to the central mass but loosens when ripe. The sexes do not seem to be well distributed: the first plant to produce flowers only gave 2 female flowers and a quantity of males, the 2 females were polinated and became fertilized. Other plants grown a long distance away only produced a large number of female flowers and these had to be polinated by male flowers brought from the first plant. A very large number of fruits were produced. The fruit is not supposed to be edible, yet as it is so prolific it is a great pity, as it looks as if it might be used as papaws or melons. The seeds yield a certain oil.

BRITISH GUIANA AND THE WEST INDIES A SOURCES OF POWER ALCOHOL.

At the request of the Department of Scientific an Industrial Research, a questionaire was sent by the Coloi ial Office on the 26th April, 1920, to British Guiana an the following West Indian Islands: Bahamas, Barbado, Bermuda, British Honduras, Jamaica; the Leewar Islands: Antigua, Dominica and St. Christopher-Nevis Trinidad; and the Windward Islands: Grenada, St Lucia and St. Vincent.

The position as indicated by the replies regarding the possibility of producing power alcohol in British Guiana and the West Indies, and of the various factors which influence it, is briefly as follows:—

The principal vegetable materials grown containing sugars or starch, are sugar cane, cassava, rice and sweet potatoes.

Comparatively small quantities of arrowroot, bananas, breadfruit, christophine, eddoes, green corn, maize, tannias and yams are produced, but in many cases in quantities barely sufficient to meet local food requirements.

The only materials of importance referred to containing cellulose are sisal waste in the Bahamas, and "weeds and grasses innumerable" in British Guiana.

The molasses from the refining of sugar is the only raw material for the production of power alcohol which could be made available at present in any appreciable quantity; the quantity depending however, on the price the molasses would fetch for the manufacture of rum and of cattle food. It is somewhat difficult from the replies to arrive at any definite figures as to the molasses which could be turned into power alcohol, it would appear however that not much over two million gallons a year could be produced. In this connection information has recently been furnished by the West India Committee to the effect that, based on an estimated output of 300,000 tons of

sugar, yielding 40 gallons of molasses a ton, and allowing for the molasses for rum and other purposes. there would be enough molasses for about 3,400,000 gallons of 95% alcohol; in either case the quantity is small.

The possibilities of the manufacture of power alcohol from molasses in British Guiana and the West Indies, or alternatively of sending the molasses to this country for conversion into power alcohol, were discussed at a conference held recently at the Department of Scientific and Industrial Research, at which the West India Committee and the home distillery interests were present, and the matter is being considered by them. It would appear that only concerted action by these two bodies is likely to produce results so far as molasses is concerned.

The only other raw material mentioned in the replies as existing in any quantity is sisal waste in the Bahamas, which on the figures given should be capable of producing about 530,000 gallons of 95% alcohol a year, and weeds and grasses in British Guiana; no particulars of the latter are given, however, and they cannot be regarded as an immediate source of power alcohol owing to their being no cheap and simple process for their conversion.

The other main crops, namely, cassava, rice and sweet potatoes do not appear to be produced in quantities in excess of local food requirements, and their present prices make them prohibitive as raw materials for the production of power alcohol. Increased output on a scale much in excess of food requirements would no doubt reduce prices, but it is a question whether the reduction would meet a level at which the material could be used for the production of power alcohol, before it would no longer pay to grow the material at all. In this connection there is a factor which cannot be lost sight of, and that is the tendency of the agricultural produce of the islands towards Canada and the United States.

The possibilities of increasing the production of the sugar-cane, cassava, and other raw materials depends, in great measure, on the supply of labour, and it would appear that, owing to the stoppage of East Indian immigration, labour is scarce, particularly in Trinidad and

British Guiana. In Jamaica difficulties of labour supply exist owing to the increased exodus of labour to the neighbouring South American Republics, where rates of pay are higher. The question of Indian labour has been taken up with the Indian Government, and in Trinidad the wages question has been under investigation by a Wages Committee. Apart, however, from scarcity unskilled labour is cheap, and what there is of skilled labour is comparatively cheap also.

Another matter which would adversely affect the cost of producing power alcohol in the West Indies is the absence of coal, except what is imported at a cost prohibitive for such a purpose. Wood is the common fuel; but in most cases it is neither abundant nor cheap.

The provision of the necessary supplies of water might also present difficulties in many of the islands.

Conclusion.

Of the raw materials in British Guiana and the West Indies suitable for the manufacture of power alcohol, the only one produced in any quantity is molasses, and the availability of molasses depends upon whether a higher price can be paid for it for this purpose than it will command for the manufacture of rum and of cattle food, which is unlikely unless the demands for rum become much less. The quantity of 95% alcohol which could be produced from the molasses not now used for other purposes would not on the most favourable estimate, much exceed 3,000,000 gallons a year.

Other edible vegetable materials are not produced in excess of food requirments, and the only waste product of importance referred to is that from the treatment of sisal in the Bahamas which, on the present method of working the sisal, would produce about half a million gallons a year of 95% alcohol.

In view of the labour position in British Guiana, and the larger West Indian Islands, and to the scarcity and high cost in many cases of fuel and water, the prospects are not very promising of increasing the cultivation of materials containing sugar or starch to such an extent as

to largely exceed the demands for foodstuffs, and by so doing of obtaining a cheap supply of these materials for the manufacture of power alcohol. At the same time there is no doubt that cassava can be grown freely in British Guiana giving a yield of six to eight tons of tubers an acre, with possibilities of increase if the best varieties are selected and properly cultivated a yield of say 7 tons an acre would produce about 250 gallons of 95% alcohol, a very good return.

The total area of British Guiana is below 57 and 58 million acres, of which over 10 millions are easily accessible, and of these again only about 200,000 are actually under cultivation, there should be therefore plenty of land on which additional cassava could be grown.

The cultivation of cassava has also been studied in Trinidad and St. Vincent and in the latter island the conclusion was arrived at in the report of the Agricultural Department for 1918—19 that, provided the cost of production could be lowered by improved methods of cultivation, etc., the manufacture of power alcohol from cassava might be found to be profitable.

Provided therefore that labour and fuel difficulties could be overcome, the cultivation of cassava on scientific lines as a raw material for the manufacture of power alcohol would appear to offer possibilities in the West Indies, and more especially in British Guiana.

MEMORANDUM ON THE PRODUCTION OF INDUSTRIAL ALCOHOL IN BRITISH GUIANA.

Including the Replies to the Questionnaire previously alluded to which was sent out by the Department of Scientific and Industrial Research.

BY THE DIRECTOR OF SCIENCE AND AGRICULTURE.

Several years (13 to 16) ago much attention was directed in British Guiana to the possible use of crude spirits of from 85% to 92% absolute alcohol by volume for fuel and lighting purposes. A memorandum was prepared and published; the section of the Spirits Ordinance dealing with the methylation or denaturation of spirits was amended and re-cast and special Orders as to the methylation or denaturation of spirits were issued by the Governor-in-Council.

Trials were made on certain plantations with motor-ploughs using crude spirits as fuel in internal combustion engines. These soon ceased as the market price of rum rose far above its parity with that of petrol. At present this position is accentuated and there is not any likelihood of industrial alcohol prepared from locally produced molasses falling below the parity of imported petrol unless British Guiana either "goes dry" or the retail prices of imported spirits—gin, hollands, brandy, and whisky—fall so low as to materially prejudice and thus restrict the consumption of locally produced rum. A similar position would be produced by the prohibition of the consumption of rum in Great Britain and her dependencies, or by their imposition of duties on rum so high as to very materially lessen its consumption, In such cases approximately 3,000,000 gallons of industrial alcohol could be prepared in British Guiana from the molasses produced on the areas at present occupied by sugar cane. But there would always be the possibility it might pay the planters better to utilize the residual molasses as a constituent of cattle-food as is now done in the case of molascuit, than to convert it into industrial alcohol.

Should any marked increase take place in the areas planted with sugar cane or in the yields thereon, it may become necessary to either convert some of the residual molasses into industrial alcohol; or to use it in compounding cattle-foods, or directly as fuel.

The answers to the Questionnaire are as follows:—

(1.) *Which of the following materials does the Colony produce :—*

(a) Sugar or sugar-containing materials.	Sugar-cane (i. e. molasses as a residual product in the manufacture of Sugar)
(b) Starch or materials containing starch or similar carbohydrates.	Rice (padi,) bananas, plantains, cassava, yams, sweet potatoes, arrowroot, tannias, eddoes, maize and guinea corn.
(c) Cellulose containing materials, apart from wood and textile fibres ?	Weeds and grasses innumerable.

(2.) *What areas are under cultivation for the above materials?*

(a) 71,000 acres.
(b) Rice, 61,000 acres; other starch-containing materials, 18,000 acres.
(c) Cannot be stated; their growths are neither under cultivation nor under control.

(3.) *What is the normal yield of these materials in tons per acre ?*

(a) *Sugar-cane* from 5 to 60 tons per acre per annum. Average yield from 20 tons per acre in ordinary years to 24 tons in exceptionally favourable years. On good land under favourable conditions of rainfall, irrigation, drainage and cultivation, the average yields vary from 25 to 33 tons per acre.

(b)

	Periods of growth	*Normal Yields in Tons per Acre*		
	Months	Raw material	equal to	Starch
Rice (padi)	5 to 6	.6 to 2.1 Average 1.1 ton	„ .4	to 1.3 .7
Bananas, Cavendish or Chinese	14	6. to 8.	„ 1.	to 1.6
Plaintains	16	3. „ 5.	„ .7	„ 1.1
Cassava	9 to 11	4. „ 8.	„ 1.2	„ 2.4
„	15 „ 17	7. „ 15.	„ 2.1	„ 4.5
Yams	9 „ 11	1½ „ 3.	„ .75	„ 1.5
Sweet Potatoes	4 „ 5	2. „ 4.	„ .4	„ .8
Arrowroot	9 „ 11	... ...	... .35	„ .7
Tannias	10	½ to 2.	„ 18lb	„ 72lb
Eddoes	10	1½ „ 2.	„ .07	„ .10
Maize	4 to 5	.35 „ .55	„ ...	... ...
Guinea corn	3 „ 5	.45 „ 1.2	„ .35	to .9

(c) Not ascertainable.

(4) *What quantities of these materials could be made available for distilling purposes ?*

The residual molasses containing, say, from 9 to 12 per cent. of the total sugars in the sugar-cane.

(b) Under present conditions of lack of population and exceptional high cost of (tropical) labour, none.

(c) None. (No labour available for the exploitation of these.)

(5) *At what price per ton could supplies of these materials be available at the point of cultivation?*

Cannot state. Dependent entirely on the availability and the cost of labour.

(6) *What transport facilities are available and what would transport of these materials cost per ton?*

(a) River, or road, or railroad according to the position of the land.

(b) Cannot state. Dependent almost entirely on the availability and the cost of labour, as well as the cost of fuel.

(7) *What is the cost of skilled and unskilled labour in the Colony?*

Varies according to locality and the nature of the work. At present rates for unskilled labour are approximately:—

Agricultural workers	
Boys and women	1/8 to 2/6 per day
Men	3/- „ 5/- „ „
Porters	
Porters and dock-labourers	6/- „ 10/- „ „
For skilled labour Men	5/- „ 12/6 and upwards per day.

(8) *What fuel and water are available for manufacturing purposes and at what price?*

Fuel. Wood, and in the case of sugar-cane, megass.
Water. Rain water, river water, and conservancy water.
Fuel. Wood costs from 11/- to, at present 21/- and upwards per ton.
Water. According to its source; and to expenses of collection and conservancy.

The cost of water supplied from the great co-operative water conservancies varies from about 5d to as much as 2/- per acre to which water is served.

(9) *Is alcohol of 95% strength being produced on an industrial scale in the Colony and if so*

(a) *From what raw material?*
(b) *In what quantity?*
(c) *At what price per gallon of 95% strength?*

Not at present. Some was formerly prepared from residual molasses. It is not possible now to state the quantity produced for such purposes or the price which it cost to make the spirits.

(10) *If not, is it thought probable that 95% alcohol could be commercially produced in the Colony, from the material mentioned.*

When if ever, the price of rum as a beverage falls below its cost of production, it may be feasible to prepare industrial alcohol from residual molasses, Whether this will be done will be dependent upon the relative value of molasses used as an ingredient of cattle-food; concentrated almost to a solid mass for export; used directly as a fuel, or converted into 95% spirit.

The only other cultural sources from which industrial alcohol could be produced on the commercial scale, would be cassava and rice. But it does not appear at all probable that the colony which does not, has not, and, under present labour-conditions, cannot produce a sufficiency of vegetable or carbohydrate foodstuffs for the needs of its population, is at all likely to commercially produce carbohydrate materials for conversion into industrial alcohol. For the only carbohydrate foodstuff it produces in quantity in excess of that required for feeding its population—rice—the Colony has assured markets with prices considerably in excess of what rice could be sold at for alcohol-producing purposes.

Hence it is not probable that in the immediate future British Guiana will produce industrial alcohol of 95% commercially.

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LIBERIAN COFFEE.

Its Cultivation and Preparation for the Market.

By W. H. Matthews, Resident Agricultural Instructor, Pomeroon District.

The planting of Liberian Coffee is fairly widely performed throughout the Colony, but unfortunately sufficient attention is not given to its cultivation; hence the crops obtained are for the most part mediocre. For the purpose of helping growers to get the best possible yields the present article is written. In it are indicated the lines along which the plants should be cultivated for best results, and as at present prices for the finished product are low, increased output is necessary to offset low prices.

By strict adherence to the principles enunciated, maximum yields will result.

Soil:—A clay soil not too stiff in texture and containing a fair percentage of vegetable matter is best for the cultivation of Liberian Coffee—while a pegassy soil grows this species of Coffee well, and indeed during the early growth of the plant it far surpasses that made by plants in soils of a clayey nature, it is, however doubtful, whether yield will be maintained so well in a pegassey soil as is the case with more fertile clay soils.

Drainage:—The provision of proper drainage for Liberian Coffee is a matter of first consideration—where the land is insufficiently drained the leaves of the plants show it by their pale yellow colour, regaining their dark green healthy colour only after the drainage has received attention.

Selection of seed:—Next in importance to proper drainage comes seed selection, as upon selection depends future yields, while it is possible in the case of short growing crops to correct errors due to bad selection or rather non-selection of seed this is not possible in the case of coffee and other permanent crops which keep on growing for years after having once been planted. Therefore it is a case with these crops of selecting "now or never."

In the case of farms or estates that are being started in districts where Liberian Coffee is not grown, perhaps the most convenient way to get plants would be to purchase plants in baskets—but in the case of established farms, where the farmer is desirous of extending the cultivation, selection of berries from his best bearing trees is recommended. As, however, selection embraces many points, it had better be given in detail below:—

(1) Ascertain during crop time the plants which give the best yields, noting (a) habit of plant as to vigour and growth (b) proportion of skin to bean in the berry.

(2) See that the plants chosen as seed-producers conform to one particular type—Liberian Coffee plants exhibit great divergence of types, hence this restriction—

choosing only one type of plant tends to uniformity of the offsprings and makes maximum yields a certainty.

(3) *Having paid due regard to the above points in selection*, gather from the plants chosen only berries that are fully ripe, (the colour of a fully ripe berry is a deep red) and the largest ones. It is also advisable to have the berries all of one size or as nearly so as possible.

Sowing:—After completing the selection of the berries, the berries can either be sown straightaway, that is, as they are in berry form; or they may be first pulped to separate the skin from the seeds, the mucilage being washed off the seeds with water, and the seeds air dried and then sown.

The correct way to sow coffee seeds is in small beds, say, 3 feet to 4 feet wide, prepared across a large 3 rod bed, paths of 18 inches being left between each for walking. These small beds should be sufficiently loose in texture and well drained. If not sufficiently loose by nature they may be made so by the incorporation of vegetable matter. Such a nursery should be made in a central place in order to facilitate the transportation of the plants to their permanent places at planting time.

As too much transplanting tends to check the growth of seedlings it is advisable in sowing the coffee seeds to set them rather far, say, 9 inches apart each way, that is, 9 inches between the rows and 9 inches between the seeds. To allow for possible failures two seeds may be set at each 9 inches space, removing one, of course, should both seeds germinate and grow. Plants growing from seeds set thus far make more robust growth and consequently do better after they have been permanently put out in their places in the field than do plants that have been set rather closely in the Nursery beds and as a consequence make leggy growth. The reason why the former make more desirable plants is the fact that widely spaced seedlings grow leaves from very near the ground and as a consequence branch low down while the leggy plants begin branching higher up the stem. It will thus be seen that in a given distance from the ground the

former will have more branches to the plant than the latter and consequently yield more.

Germination of coffee seeds takes place in 6 weeks. After sowing, watering should be done and weeds removed, and so regularly on until the seedlings are ready to be permanently planted out, shade should of course be provided for sheltering the seedlings during the heat of the day. In connection with watering only sufficient to keep the soil moist is necessary, as over watering is more harmful than beneficial, giving rise to dampness.

Preparation of the land for planting:—Before the plantlets are ready to be planted out it is requisite that the land be laid out in beds 3 rods wide by digging 2 'x 2' drains at every 3 rods. the earth thrown out of the drains in digging being thrown along the centre of the beds and so raising the middles. After the beds have been formed, lining should be done so as to mark the places in the beds where the plants are to be permanently planted. The beds being 3 rods wide leave out from each drain 6 feet distance and run rows on either side of the bed parallel to the drains and 6 feet distance from each, you will have then 2 lines or rows 24 feet apart. As it is, however, necessary to have your rows only 12 feet apart a middle row can be put in midway between the two outer rows, thus allowing 3 rows to the bed, each row being 12 feet apart, and the outer rows 6 feet from the nearest drain. The rows having been correctly spaced and run, mark off in the rows the places where the plants are to be set, leaving a distance of 6 feet clear from the edge of the bed—The first plant in each row being 6 feet from the "bed head" peg off from this every 10 feet along the row until the other .end of the bed is reached and then similarly deal with the other beds, row by row. The planting distance for each plant will therefore be 12 feet by 10 feet, meaning 12 feet between the rows and 10 feet between each plant in the rows. Undoubtedly planting in rows takes time but the ultimate gain more than compensates for the little trouble taken. By planting in rows each plant is given its own space, its own share

of light, air and soil, and consequently uniform growth is made by the plants, resulting in a uniform yield.

After lining is complete, unless the soil is very loose in texture, holes should be prepared for receiving the plants. By preparing holes is meant the excavation of the earth around each peg and the peg being the centre of the hole. The size of the holes should be 24 to 30 inches wide and 12 inches deep. The soil removed from the holes should then be well chipped and mixed with vegetable matter before returning it to the hole, raising the middle so that the finished hole is mound-shaped. Some people look on the recommendation of holing as being "high-falutin" but surely a little extra attention given to a plant that is to continue in one place, not for months, but years, is desirable. In the life of such plants the extra cost of making them comfortable and giving them a good start is more than counterbalanced by subsequent yields.

Planting:—This is to be preferably done during showery weather when sun and rain alternate. Afternoon planting is best, that is, any time after 3 p.m. The plants are carefully lifted from the beds, small openings on top of the mounds in the field made and the plants planted, pressing well down around the roots with the hands or feet as the plants are put down, after which draw up a little loose soil above the roots and about the stem but not too high up. This drawing up of the soil around the stem and over the roots will check evaporation from the soil below and confine the moisture in the vicinity of the roots where it is most needed. As a guide how deep the plants should be planted, note the mark on the stem showing depth at which they stood in the nursery beds and put them down at this depth.

Plantlets 6 to 8 inches are best for planting out in the field: although some people prefer to plant when smaller, and others when larger. Watering after planting is advisable in order to settle the soil well about the plant roots. The cooling effects of water on the roots also help plants planted in the afternoon to pick up during the cool of the night and so be in better position to withstand

the heat of the sun, should the next day after planting be a very hot one.

After-cultivation :—After cultivation embraces weeding, pruning, forking about the roots during the early stages of growth, topping and gathering the ripe berries annually after fruiting begins.

Weeding :—Liberian Coffee is a plant that must be kept quite free from weeds—clean weeded, that is, where grass and weeds are allowed to grow unrestrained the leaves of the coffee plants become very pale tending towards yellow. Further, if the grass is of the high growing kind it will be found that the lower bearing branches of the plant gradually die, while suckers arise from low down the stem giving the plant altogether quite an uncultivated look. Proper and regular attention to weeding enables the plant to make uniform growth and to maintain its healthy appearance. as is evidenced in well kept farms. As a means of keeping down the growth of weeds and at the same time getting the means of livelihood during the waiting years between the planting and gathering in the first crop, catch-cropping with ground provisions is usually done. It should not be forgotten, however, that such provision crops as are grown between Coffee are secondary to the Coffee, hence any encroachment on the Coffee plants should be prevented by sacrificing the provisions for the Coffee and not, as is often the case, the Coffee for the ground provisions. Each year as the Coffee grows and spreads the ground provisions should be planted farther and farther away, thus enabling the coffee to do its best and arrive earlier at maturity.

Pruning :—The Liberian Coffee is such a very good bearer that it will give fair returns for the minimum amount of pruning done. This fact is so well recognized by farmers, generally, that they rather under-prune than over-prune. Yet it has been the writer's experience that pruning done early and regularly has a decidedly invigorating effect on the future yields of plants. Pruning to be effective must be begun as above-said early in the plants life, and in the nursery beds, should suckers arise

on the main stem of young plants. Many farmers regard the many-stemmed plant as a better bearer than a plant having only one main stem. A consideration of the two kinds of plants soon shows the fallacy of so thinking. For while a plant having one main stem gives off its branches in regular order around the stem, the many-stemmed plants do so on their outer sides only, thus in the end being worse off, as while the two kinds of plants may have the same area of bearing branches at first and perhaps a slight difference in yield, in course of time the many-stemmed plant soon runs down in vigour and naturally in yield while the one stemmed plant increases both its crops and vigour with the years.

Besides removing suckers by pruning them off from the main stem, pruning also embraces the thinning out of the secondary and tertiary branches. Secondary branches are those growing out from the branches, while the tertiary ones are those growing from the secondary branches. If no thinning is done the plant becomes a tangled mass of branches which results in poor yields. By thinning out the branches light and air are allowed to circulate better in and about the plant thus inducing fruitfulness. An important rule to observe is to have the middle of your plant open by removing branches growing towards the middle or too near the middle of the plant. The main stem—all branches should grow outward and away from the main stem. Begin early in the plant's life to check undesirable growth and so direct growth in the proper directions. Neglecting to remove branches and shoots early only makes the work of pruning harder in the future with no benefit to the plant. Observant farmers must have noticed that where a fairly large shoot has been removed there springs up from around the mound made many more shoots which also require to be removed. Removal of shoots when just peeping out saves this extra work and benefits the plant by diverting sap into the branches which you want to grow and fruit.

Pruning further includes removal of dead wood or dried portions of branches, while sometimes the removal of some leaves is necessary.

While it is necessary to remove suckers or shoots growing from low down the stems of healthy and vigorous-growing plants (which suckers grow in an upward direction) there are nevertheless times when a sucker serves a useful purpose, such as rejuvenating an old plant or as sometimes is necessary, a young plant that has been suffering from neglect. In such cases a sucker growing from as near to the ground as possible on the stem, is selected and trained up as a new stem and subsequent suckers arising being pruned off. In course of time such a sucker grows and branches becoming a new plant. Old Coffee plants which have run to wood and are declining in yield could be treated as above mentioned. Quicker returns are obtained by so treating worn-out plants than if seedlings were planted to form a new cultivation.

Topping:—By topping is meant the stopping of the upward growth of the central or main stem of the Coffee plant by pinching off the terminal bud at top in order to concentrate its energy into the already developed branches. Topping to be effective must be done as soon as the required height has been reached. To allow a plant to grow 20 feet high and then to cut it back to 12 feet is not a desirable way of topping as the suckers arising at the top of the plant consume much labour in checking their growth. When, however, topping is done at the height desired the terminal bud is easily removed as its growth is then soft and the head of suckers that spring up as a consequence is more easily removed. Better still, disbudding is possible in the latter case. By disbudding is meant the cutting out of the buds for 4 or 5 whorls below the terminal bud at the same time as topping These buds are to be found just below the branches or whorls of branches and should be removed with some of the wood, deep enough to get out the buds entirely. When topping is done it is the buds nearest the top of the plant that shoot up, as it were, to replace the terminal bud removed, by continuing the upward growth. Therefore to make the topping effective and save time you disbud these buds and prevent their growth once for all.

As regards height at which to top there is no laid-down rule. Some people top at 4 feet while others do not top at all. As, however, observation of plants allowed to grow unrestrained shows that the plant becomes soon exhausted, topping is advisable to save the plant from itself, as it were. The writer considers a minimum height of 6 feet, and a maximum of 12 feet, about the best where high or low topping is desired. While topping increases fruitfulness it must also be remembered that the crop of a coffee plant depends on the number of bearing branches therefore the greater the number of bearing branches to a plant the greater the crop. Some people, however, prefer low plants of 6 feet height in preference to trees of 12 foot height as saving the use of cumbersome ladders. Topping at 12 feet will however, give maximum crops without seriously affecting the vigour of the plants.

Crops:—Liberian coffee arrives at its full bearing stage in from 5 to 7 years. This does not mean that no berries are borne until 5 years but rather that a full crop of berries is not borne until the tree reaches 5 years at the earliest. A few flowers, and therefore berries, will be borne sometimes as early as 2 to 3 years but not until 7 years will the tree give its best yield. An average yield of from 8 to 10 lbs is given by one plant at 7 years of age. Individual plants, however, sometimes give yields far in excess of this but this is rather the exception than the rule. And here is where the value of selection comes in. For while on a farm will be usually found many plants giving poor yields, a few plants giving average yields, and fewer still giving high yields due to non-attention to selection, a cultivation consisting of properly selected plants will give uniformly high yields; hence the advantage of selection over non-selection of plants or seed.

In gathering the crop (which starts about the latter part of November or in December, according to weather conditions, and continues on to February or March of the next year) only the properly ripe berries should be picked. A ripe berry is of a deep red colour. The

berry alone should be removed in picking, leaving the stem on the plant, or rather, the branch. This is important as if the stem is removed it reduces the next crop as is the case with Cocoa. This accounts for the reason why when ripe berries are left on the tree to dry the next year's crop is much reduced. It therefore pays to pick ripe berries from a plant, instead of leaving them to dry on the tree, as the producing powers of the plant is thus maintained. Farmers who do not pick off the ripe berries from their plants, because, they say, it does not pay at present prices, are injuring their plants and will find, should prices rise, that they have made a fatal error in not so doing.

Pulping:—Coffee berries should be put through a pulping machine as soon after picking as possible as delay in so doing makes pulping difficult. Fresh berries pulp more easily than when left over for some days. The pulping makes possible the separation of the skins from the beans by crushing the berries without injuring the beans and their parchment covering.

Fermentation and washing:—After the beans come out of the pulper they must be put up into heaps so as to allow fermentation to take place and so cause the mucilage on them to be readily removed by washing. The time allowed for fermentation is 3 days, and during this period the heaps should be regularly turned so as to equalize fermentation throughout the heaps. At the end of 3 days the fermented coffee beans are put into large boxes and subjected to running water so as to remove the mucilage on the parchment covering of the beans. For small lots of fermented beans a tub can be used by half filling it with water and putting in enough beans to allow of complete washing off of the mucilage. A hole in the bottom with a plug to stop water from running out is necessary. Should the first water not completely remove the mucilage fresh water can be added after allowing the first water to drain through the hole in the bottom of the tub by removing the plug. Rubbing between the hands hastens removal of the mucilage in washing.

Drying:—After the mucilage has been removed, by washing the beans in their parchment covers are then put out, after first draining the water from them, to dry. Wooden platforms having movable shelters over them are used for the purpose, sometimes the platforms are movable and the shelters permanent. In any case the object of drying is the same. It is necessary in spreading out the washed beans to dry, that they be thinly spread, as a more uniform drying takes place. Frequent turning during drying should be done. With the maximum number of hours of sunshine per day drying takes from 6 to 7 days, but longer, should the days be intermixed with cloudy days. To arrive at a correct idea as to whether drying is complete, the method employed is to test a few beans, after removing the parchment covers, by pressing on the bean with the thumbnail. If the nail cuts into the bean further drying is necessary; but if the thumb nail does not cut into the bean when pressed, drying is complete.

Hulling:—After drying has been completed there remains the last process of hulling, to separate the parchment covers or hulls from the beans. This is done by a hulling machine on large estates, or by pounding in a mortar on very small estates. As the hulls go one way and the beans another, the beans can at once be bagged off as they drop from the hulling machine, thus packing or bagging while hulling is in process for shipment.

A new method of treating Coffee berries:—The above process is the recognized way of preparing Coffee for the market but some years ago a new method was tried in Pomeroon and proved so successful as to be now the fashionable method. It differs from the recognized method in that washing is eliminated. The pulped Coffee after being fermented is spread out on the drying platforms straightaway. Drying, however, in this case, takes 3 days more, as the mucilage is not washed off. When drying is complete, hulling is done as before and the hulled product put into bags for shipment. It may be mentioned incidentally that a standard bag of Coffee contains 200 lbs of cured beans. An advantage, to the

farmer of the latter process is that the cured product is heavier in weight than when prepared according to the formed method. The Coffee drinker has also the advantage of an improved aroma, approximating that obtained from berries allowed to ripen and dry on the trees. No doubt the mucilage which probabiy is absorbed by the beans in drying is accountable for the improved aroma.

Pests:—Fortunately there are a few pests but no disease that trouble Liberian Coffee plants in this Colony:—(1) Scale insects are sometimes found on the plants but only in a mild form. (2) Bird-vines are, however, exceedingly troublesome, if left unrestrained, and kill the plants when so left. The farmer who, however, prides himself as a farmer will see to it that bird-vines do not get a foot hold on his plants by removing them as soon as seen. (3) Black ants are sometimes a nuisance to pickers but they are only present to an appreciable extent where weeding and keeping the plants free from vines and other undergrowth have been neglected, as also where pruning is conspicuous by its absence.

AGRICULTURAL NOTES.

Rice And Its Risks.

An interesting extract from the Journal of the Board of Agriculture, Vol. 2, No. 4 April, 1909. We have appended some figures relative to the acreage under rice, sugar and other products in British Guiana during recent years which indicate that rice, despite a number of vicissitudes, still continues to flourish and somewhat more than hold its own in competition with other crops.

Enthusiasm is an excellent thing—even a very excellent thing—but it should be tempered with judgment. No one will deny the present importance to the colony of the rice industry or fail to give due credit to

the enterprise, energy and independence of its pioneers. Within a short space of years they have developed the resources of the colony in an unexpected direction and to a phenomenal extent. They have left a permanent mark on its history and enlarged its prospects: and that without any aid but that afforded by a series of congenial seasons and favourable markets. Unfortunately the "but" is a big one; and those who do not wish to live in a fool's paradise must face the facts that seasons may change and markets fluctuate. In that case, what will become of the rice industry?

The risks which the growing of rice in British Guiana involves are patent, and have already been dwelt upon at commendable length and with praiseworthy persistence by the daily Press of the colony. It is on record that the industry on the Corentyne Coast was virtually extinguished by drought in 1899. It is admitted that the question of irrigation is vital and pressing. The effects that must follow a considerable fall in the market price have been less emphasized, but are none the less important. India is a factor in the problem which must never be lost sight of, although various circumstances of late years—years concurrent with the rise of rice in British Guiana—have combined to eliminate the influence of the great Eastern Dependency. With India once again famine-free and able to export the cereal in normal quantity, what, we repeat, would become of our rice industry?

The question, if disconcerting, is appropriate enough in view of an undeniable waning of interest in provision growing. This unfortunate tendency is unmistakably indicated. The reports of the Department of Science and Agriculture leave little doubt on the matter. Before us lie the results of the Farmers' Competition on the East Coast, held under the auspices of the Buxton Farming Association, and the comments thereon of the Director and the members of the Exhibition and Subsidiary Products Committee. From these it is evident that the enthusiasm in agricultural matters aroused among the farmers during recent years has either dim-

inished or been transferred to the cultivation of rice—with all its risks. In other words the local "small man" is taking the perilous course of putting all his eggs into one basket, and that a receptacle which it is admitted may give way at any moment. It is true that a great American humorist has altered the ancient proverb to read: "Put all your eggs in one basket—"*and watch the basket*," but however suitable that emendation may be to business or Yankee finance, it would be fatal if applied to farming. There is much that the skilful and scientific agriculturists can influence—soil, drainage, supply—but the fundamental conditions under which he works—climate and seasons, sunshine and rainfall—are beyond his control. Even the incidence of disease and the appearance of insect pests cannot be anticipated in most cases, and he is indeed a foolish man who exposes himself to the danger of having the whole of his means of subsistence destroyed at one fell swoop. By cultivating a variety of crops the wise man insures himself against disaster. Conditions that may be adverse to one crop are often eminently suitable to another. Diseases that attack one plant pass another by. Pests are frequently nice in their appetite. There seems no reason why the fashion or rice-growing should imply the neglect or abandonment of other and safer cultivations. Rather the opposite. Common sense and experience both argue the other way, and we would not be behind hand with our warning. We are mindful of the fact that agriculture is a business; that farmers naturally look for their profit where they can most easily find it; and that provision growing is subject to certain disadvantages, of which praedial larceny is not the least. Yet for this last, at any rate, the remedy is largely in the hands of the villagers themselves. If public opinion in the country districts was seriously and unmistakably against the provision thief, the hands of the Government would be immensely strengthened. The law can provide "catting" for the culprit when caught and convicted; and energetic public spirit, by organizing vigilant societies or what not, would see to it that he was caught.

The paralyzing effect of praedial larceny on industry and thrift justifies the strongest measures, but its occurrence cannot be put forward as a valid excuse for so modifying the choice of cultivation as to expose great portions of the colony to the risk of grave disaster. We have no desire to see an Indian famine repeated here on even a small scale; yet the failure of the rice crop might mean all that if the present tendency be not stopped. And, as usual, it would be the poorer classes who would be the chief sufferers. We would do nothing to check enthusiasm; but we would seriously warn the farmers of the colony to make sure that their enthusiasm does not lead them to neglect precautions which their sober judgment must suggest.

	Acres under Sugar Cultivation.	Acres under Rice Cultivation.	Acres under other Products.	Total area under Cultivation.
1908	74,865	39,746	33,356	147,967
1913	72,898	35,582	43.832	152,072
1914	73,108	47,037	49,389	169,534
1915	75,744	50,737	49,888	176,369
1916	78,346	57,022	51,117	186,485
1917	77,828	58,090	55,762	191,680
1918	73,565	60,432	63,890	197,887
1919	70,876	61,400	58,341	190.717

Power Alcohol From Rice Straw.

According to an article in *Nature*, October 21, 1920, dealing with possible new sources of power alcohol, an interesting recent proposal has been made. This is, that alcohol for industrial purposes may be obtained from rice straw and husks, a cheap raw material available in large quantities in rice-growing countries. The process proposed is to soften the straw by steaming; it is then treated with hydrochloric acid, or with calcium hypochlorite and chlorine, to disintegrate the fibres; it is then pulped, and

the hydrolysis of the cellulose and starchy matter completed by means of diluted hydrochloric acid. After the conversion of the sugar takes place, the acid is neutralized, and the solution of sugars fermented and distilled. It is stated that arrangements have been made for large scale experimental trials of this process in India, with the view of ascertaining whether the production of fuel alcohol from these and similar cheap cellulose materials can be definitely established.

Experiments are also in progress to ascertain whether a micro-organism can be obtained, which will effect the direct conversion of cellulose into fermentable sugar. Success on the lines of this or the preceding process would open up the prospects of utilizing a large amount of waste cellulose substances as sources of industrial alcohol.

Losses in Harvesting Burnt Cane.

Whenever burnt cane was harvested, corresponding areas of unburnt cane from an adjacent strip of land were also harvested, to serve as a check on the results. All the canes in half of the burnt field were allowed to stand until harvested at the times mentioned. The canes in the other half of the field were at once cut down after burning, and allowed to lie on the ground until harvested. The harvested canes were weighed and then milled, and the composition of the expressed juice estimated by ordinary analytical methods.

The following results were obtained:—

1. Cane harvested within a few hours after the fire showed no loss due to burning. The heat generated by the fire destroyed a quantity of sugar, so small that it could not be detected in the laboratory.

2. Burnt cane allowed to stand and tested after five days, was found to have lost 6·57 per cent of its weight, and 15·23 per cent. of its sucrose. If cut immediately after burning and left on the field, the losses at the end of five days were 15·30 and 14·22 per cent. respectively.

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Losses in Harvesting Burnt Cane.

The opening of the crop season with its attendant period of prevalence of cane fires raises the interest of planters in the question of the deterioration of canes that have been burnt. Recently J. A. Verret has recorded data from an experiment carried out at Ewa plantation, Hawaii, on a special field of first ratoon canes on the 1920 crop. The object of the experiment was to determine the losses which take place in handling canes from large accidental or incendiary fires. The following summary is abstracted from an account of Verret's work as published in the *Louisiana Planter* for January 15, 1921.

A uniform field of about 3 acres of canes was selected and divided into twelve areas, each of which was subdivided into four plots, 'A,' 'B,' 'C', and 'D'. The 'A' plots were harvested *immediately* after burning, the 'B' plots five days later, the 'C' plots ten days, and the 'D' plots fifteen days after burning.

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3. At the end of ten days the losses were, for standing cane, 11·39 per cent. of cane and 29·23 per cent. of sugar; for cut cane, 22·45 per cent. of cane and 30 26 per cent. of sugar.

4. At the end of fifteen days the losses were, for standing cane, 20·89 per cent. of cane and 51·66 per cent. of sugar, and 29·18 per cent. of cane and 48·80 per cent. of sugar for cut cane.

The result is somewhat unexpected, for the figures show that after the cane was burnt, it made no appreciable difference in the loss of sugar whether the cane was allowed to stand, or was cut. So that there is no advantage when reaping a crop of burnt canes, to hold back the cutting so as to keep pace with the loading and carting. Indeed there is an advantage in immediate cutting, since there is less weight to handle in reaping long-cut canes than in reaping canes that have only just been cut.

5. When burnt cane is allowed to stand the density of the juice tends slightly to decrease, but when cut at once, there is a decided increase in density of the juice. In the experiment described the increase was from 18·6 to 22·1 Brix degrees in fifteen days.

6. The quotient of purity of juice of burnt cane, whether standing or cut, was depressed at about the same rate.

7. The number of tons of cane needed to make one ton of sugar was greater for standing burnt cane than for cut burnt cane. So that cutting is advantageous from the manufacturer's point of view.

It would appear advisable, therefore, after a cane fire, to cut the canes at once and follow up the loading and carting at a rate decided by the capacity of the transport vehicles used.

How To Keep Seed Corn.

The following simple method of treating corn against infestation, may interest growers in places where there are no corn-granary facilities. The extract is taken from Circular No. 18, Porto Rico Experiment Station, on the selection of seed corn in Porto Rico:—

Among the great many samples of corn received in this office during the last eighteen months, none was in better condition than those which had been dried in the kitchen and subjected to smoke from the charcoal stoves. This is a thoroughly practical method, and should be more widely applied, but is now used to only a limited extent. In most places it would be not at all practical to turn the kitchen into a corn-drying establishment, yet anyone can dry and smoke a large number of ears in a home-made contrivance.

'For this purpose use two barrels, after knocking the heads out of both; also a box which must be slightly longer and wider than the diameter of the barrels, and from 13 to 18 inches in depth. After removing the

cover of the box, cut a hole slightly smaller than the diameter of the barrels in the bottom, then another hole about 12 inches square in one side of the box close to the top. Place the box, bottom up on the ground, with one of the barrels on the top, covering the hole previously made. Put the second barrel on top of the first one, and secure the two in an upright position with braces. Now place a charcoal burner in the box, using for fuel, charcoal with corn cobs and other such material as will produce considerable smoke without blaze.

'Hang in the upper barrel the ears of corn which have been tied in a long string by a series of slip knots and suspended from stout sticks laid across the top. The drying and smoking process should be continued for about a week, care being taken never to let the fire blaze. A temperature of 135° F. is perfectly safe, but 145° F. may cause some injury. The germ in all the kernels will be killed by a temperature above 160° F. continued for any length of time.

'After the ears have been well dried in this manner, all insect eggs will be killed, the smoky condition acting as a repellent against further infestation.' As indicated below, the ears may then be packed in a tight barrel or box. On the bottom of the barrel place about 2 inches of air-slaked lime, next a layer of ears, filling in the spaces between the ears with lime. When this container has been filled in this manner, finish with a few inches of lime to cover the upper layer of corn. Packed in this way, corn may be kept perfectly safe from one season to another, the lime absorbing surplus moisture, and preventing weevil from entering.

A FISH EPISODE.

Mr. A. L. Hager, general manager of the New England Fish Company, Vancouver, who has always shown great interest in having his employees look out for rare specimens for the Museum, and through whose efforts several species have been added to the Provincial Museum collection, wrote to the Director on February 11th, "that Mr. Walter White, for many years employed as a halibut-fisherman on the vessels of the New England Fish Company, and latterly as mate on the S.S. 'Kingsway,' brought to their office a rock weighing about 2½ lb. Mr. White states that he personally took this rock from the stomach of a halibut weighing about 60 lb. The S.S. 'Kingsway," was fishing off Bonilla Island at the time in about 35 fathoms of water. It occurred to us that you might like to receive and preserve this rock."

This rock was eventually sent to the Provincial Museum by Mr. Hager. Later I sent a copy of the letter, as requested by Mr. Hager, to Mr. Will F. Thompson, Assistant in charge of the Long Laboratory, California, for his information.

Mr. Thompson is a well-known fish expert on the halibut fishes, and has done considerable scientific research-work in the Northern British Columbia halibut waters. In reply, Mr. Thompson writes as follows;—

"Many thanks for your letter with the copy of the note on the rock swallowed by the halibut. It is perfectly possible. The halibut are famous eaters of small things, and they pick from the ground, rocks, etc., and all sorts of things, including sea-anemones, clam-siphons, etc., and in the process of doing so they frequently take in many things which are not intended to find a lodging in the stomach of fish The famous stones which the cod takes in (as ballast) in storms are the results that follow too reckless eating on the part of the cod. The size of the stone, however, is a most surprising thing. It bears witness to the reckless habits of the halibut."

—*Report of the Provincial Museum of Natural History. British Columbia, 1919.*

PORT MOURANT-ROSE HALL FARMING ASSOCIATION.

The President and Officers,
B. G. Farmers' Conference,
Gentlemen,

I have the honour to submit a report on the work of the Port Mourant-Rose Hall Farming Association for the year ending 31st December, 1920. The event of chief interest and importance which has taken place in our district was the meeting of the Fifth Annual Conference in April last year, an event which has been fraught with vital results.

The Executive Committee have assisted in the establishment of two farming associations—one in the Bloomfield-Manchester district, and the other at Kildonan. The absorbing topic of the day is the extension of the Cane farming industry. Series of meetings have been held in connection with this matter, and our members cannot adequately express their satisfaction and pride of the spirit and ardour of the Revd. E. R. O. Robertson, who has taken such a deep interest in our welfare. We beg to commend him for the thoroughness in which he performs any work entrusted to him.

A loan of $6,500 was negotiated with Messrs. Curtis Campbell and Company for the purpose of empoldering and planting 61½ acres with canes in the provision section of Rose Hall Village.

A Sub-Committee was formed for the purpose of formulating a scheme in which they were ably assisted by W. H. Watson, Esq., *Deputy* Manager of Pln. Albion. As our Association is not a corporate body, it was decided that the Local Authority should be their sureties.

The scheme was submitted, and the estimate approved, except the item with regard to planting—

which the Inspector of Districts stated should be undertaken by the Loan Bank—a proposal which was rejected by the cane farmers.

No further development has taken place, so the scheme is in abeyance.

We are pleased to record our sincerest thanks to the Manager of Pln. Albion—Jas. Bee, Esq.,—for his kindness in issuing temporary loans to cane farmers to assist them in the cultivation of their crops.

Loans amounting to about $600 were given, and the farmers made prompt repayment.

The crop was reaped in the month of October. Payment was made on a basis of $13.57 per punt loaded to a depth of 10 inches.

We deeply deplore the resignation of our President, C. A. Birtles, Esq., who has been compelled to relinquish office on account of his departure from the district. During the tenure of his office for two years, he has rendered very valuable services to the Association. Being a planter, his intimate knowledge of cane farming has been of considerable value to us. We beg to express our deep appreciation of his advice and the help he has rendered to the Association from its inception.

We have to refer also to the loss sustained by the transference of the Revd. T. Wilkes, Treasurer and founder of the Association—to the Parish in the Canje District. He took a deep interest in the welfare of the people, and always endeavoured to foster the spirit of co-operation.

Thirty four members were admitted during the year. The receipts were $58.70 the balance carried forward from 1919 was $40.62 making a total of $99.32. The expenditure amounted to $48.76, leaving a balance of $50.56.

Wm. W. F. Sullivan,
Hon. Secy.

26/3/21.

BOTANICAL, PLANT DISEASES AND PEST NOTES.

WATER HYACINTH: A PEST.

One of the most beautiful flowering aquatic plants is known as the water hyacinth (*Eichornia crassipes*), which has become, however, a serious menace to navigation in the rivers of Florida. It may be mentioned that another species of the same genus, *E. azurea*, is highly prized as an ornamental plant for growing in ponds or tubs in the West Indies. This species, however, is not as vigorous in growth as its congener, and would not be so likely to become a pest.

How the plant became established in Florida is not exactly known, but it seems to have been introduced as an ornamental aquatic, and to have been first planted in a pond, where it soon became so abundant as to necessitate control, and it was taken up and thrown into the St. John's River.

In addition to its interfering with navigation, the spread of the water hyacinth in the St. John's River and its tributaries caused at one time considerable loss in the value of the timber floated down that stream. Moreover, the rank decaying vegetation is a menace to sanitation, as it not only affords a shelter and breeding place for disease-carrying insects, but interferes with the disposal of sewage.

The story of this plant in Florida affords a striking illustration of the danger of inconsiderate introduction of plants from one region to another.

The following account of the campaign for the eradication of the water hyacinth from the streams of the Southern States is taken from an article in the *California Monthly Journal*, March, 1920, which also contains a warning as to the danger of introducing the plant into the rivers of that State.

The water hyacinth has now become so abundant in Florida, Louisiana, and Texas as to obstruct navigation in the

waters emptying into the Gulf of Mexico. Its eradication was entrusted in 1899 to the United States Engineer's Office of the Water Department. From that time the Engineer Office has worked continuously on eradication, and has spent hundreds of thousands of dollars in attempting to remove it from navigable streams.

No method has ever been found which will completely remove the plant at a reasonable cost, but the solution which has been found most effective is an arsenical spray.

The water hyacinth is eaten with relish by stock, and in Florida its use as a feed has become so well established that it was considered necessary, in making an appropriation by the Rivers and Harbours Act of 1905 for the removal of the plant from the St. John's River and other navigable streams of Florida, to insert a proviso that "no chemcial process be used injurious to cattle." It was at first attempted to break up the masses of the plant and push the pieces into the current, but this was found unsatisfactory, and exceedingly expensive. Since 1909 an elevator fixed to a barge has been used, which gathers the plant in much the same way as kelp is gathered. Fixed booms are maintained across non-navigable streams to prevent the floating into navigable streams, and movable and semi-automatic booms to prevent its floating from one navigable stream into another. Labourers and watchmen are employed to detect or prevent the spread of the plant.

In the other Gulf States, the use of chemicals is not prohibited, and although difficulties are encountered by owners of stock along the streams allowing their animals to eat the sprayed plant, with fatal results following, local co-operation is generally obtained in combating the pests.

In Louisiana two barges, propelled by gasolene launches, and equipped with tanks for mixing, and pumps for spraying the chemical solution, are kept continually in service from about April 1 to December 1 each year.—*Agricultural News.*

The Kurua Palm.

On pages 172-174 of Vol. XVIII. No. 2 Bulletin of the Imperial Institute for April-June, 1920 there appears a report on oil made from the Kurua (Curua) palm (*Attalea spectabilis* Mart.) the fruit being sent from Brazil.

The "Kurua" palm is mentioned in a report dated 1879 by the late Government Botanist, G. S. Jenman as occurring on the Courantyne River from Epira upwards, and by Chas. Barrington Brown in "Canoe and Camp Life in B.G." on the upper Courantyne and New Rivers. It is to be found in the Berbice River, to my knowledge in the vicinity of Wikki and upwards and at various places between Berbice and Demerara Rivers inspected during the Cattle Trail Survey. I understand it is also to be found along the upper Essequibo River and in Rupununi District.

In comparing the results of the Examinations of Kurua fruit with those of Kokerit from this Colony (Vide report on pp 8-13 of Vol. XIV. No. 1 of 1916) it is seen that the yields are somewhat similar as shown hereunder:—

(a) Per cent. of yield from whole fruit:—

Pericarp	Kurua	15.5	Kokerit	17.0
Pericarp oil	„	2.9	„	2.6
Kernels	„	13.2	„	17.0
Kernel oil	„	(not stated)		9,7

(b) Per cent. of yield of oil from the dry kernels:—

Kurua	65.3	Kokerit	64.1

The "fat" or oil from the pericarp of Kurua was of greenish colour and semi-solid, while that from Kokerit was orange-red and semi-solid. The fat from the kernels in each case was, respectively, "a soft pale cream-coloured solid" and a fairly hard, "cream-coloured fat"; both are stated to be edible oils.

The chemical analyses of the kernel oils and the meal cakes are also very similar.

It was stated that Kurua kernels should realise a higher price than oil palm kernels and the latter was quoted in July, 1920 @ £31 per ton in the United Kingdom, while it was stated that Kokerit kernels should fetch the same price as palm kernels or possibly a little more, the price of the latter being quoted in May, 1916 as £20. 5s. in Liverpool.

L. S. HOHENKERK.

19.3.21.

LOCUSTS IN ASIATIC TURKEY.

The Union Department of Agriculture of South Africa has carried out some extensive campaigns against locusts, but its work seems small in comparison with work carried out against locusts under German supervision in parts of Asiatic Turkey during the war. A German publication reviewed in a recent issue of *Review of Applied Entomology*, states that in 1915 Anatolia, Syria, and Palestine suffered greatly from locusts. An anti-locust campaign was then organised, with a staff of 14 directors, 72 officers, 2,000 supervisors, and about 11,000 men from labour battalions and compulsory levies from the population. An average of 450,000 to 500,000 workers, it is stated were employed daily from March to May, 1916 in western Anatolia, and 6,000 tons of locust eggs and 11,000 tons of locusts were actually collected. The barrier and pit system of trapping was the chief measure used against the voetgangers. Poisoning was also resorted to with success, but no practical results were obtained with fungoid and bacterial diseases. For work in the following season 250 non-commisioned officers and 2,500 men were detailed as instructors, while provision was made for the supply of about 300 miles of zinc strips to serve as barriers and 50 tons of arsenic and paris green for use in preparing poison baits.—*Journal of the Department of Agriculture, South Africa.*

To Keep Cut Flowers Fresh.

It may be of interest to readers of the *Agricultural News* to know that, in most instances, cut flowers for use in vases and bowls in the house will last much longer if the stems are cut under water. The flowers cut in the garden are brought into the house, aud when they are being arranged, the ends of the stalks are trimmed afresh, a neat, clean cut being made with a sharp knife or scissors actually under water in a bowl or basin, or in the running water under a tap.

The object of this proceeding is to prevent the searing over of the cut surface, which results if the air comes in contact with it. If the cut is made under water, a film of moisture forms on the cut surface and the air does not come in contact with the several tissues.

This method is beneficial in dealing with a wide range of flowers, from gaillardia, calliopsis and begonia, as examples of soft tissues, to bougainvilaea, allamanda, and other very woody-stemmed plants, as well as roses, snapdragons, and others with moderately hard stems.—*Agricultural News.*

IMPRESSIONS OF THE B. G. FARMERS' CONFERENCE.

By Rev. W. A. Deane.

The sixth Annual Conference of the British Guiana Associated District Agricultural Societies held at the Congregational school-room, Beterverwagting, East Coast, Demerara, on 5th and 6th April, 1921, was a record-breaking one.

Those actually engaged in the production of canes, rice and other commodities for consumption in, and export from, the Colony were well represented; the number being about one hundred.

The most striking feature of the Conference was the goodly number of young men of brains and training of the African and East Indian races identified with "the tilling of the soil" than which, after all, there is no nobler or more independent calling; the conclusion drawn is, therefore, that dignity to agricultural labour in our agricultural country, has, at last, taken deep root now, which is due to agriculture having formed part of the curriculum of our Government Elementary Schools. This change began about twenty years ago.

It is due in part, also, to the stimulus given to agriculture by the timely birth and healthy existence of the B. G. Farmers' Conference; to the Board of Agriculture, to the Department of Science and Agriculture under the directorship of the Hon. Professor Harrison, C.M.G., M.A.

Added to the above persons, the Rev. F. Denny and Mr. H. Aaron Britton, the newly elected President of the Conference and one of the best, if not the best young leaders of the people, the Rev Eric R. O. Robertson, who, I might say has "kingdoms in his pulses and empires in his brains."

Discussions on cane farming were acute and well-measured; the basis of payment of farmers' canes by the Sugar Planters' Association having very nearly reached the stage of satisfaction or settlement.

The element of distrust between the farmers and planters will have been destroyed as soon as that further compromise is conceded by the Planters' Association, most of whom are worthy of admiration and high esteem for their "much give and take" policy.

That executive members of the Conference, it was decided, should reply to the matter from the Planters' Association importunately requesting that the option to take sugar or money should be with the cane farmers and that a little more consideration for the payment of canes should be allowed them.

The further growth of the cane-farming industry only recently begun on the West Coast of Demerara on estate lands given on good conditions by Messrs R. Strang and G. E. Anderson will be a matter of fact when the misunderstanding is removed.

The gloom over the Conference was the regrettable absence owing to illness of the Rev. J. F. Denny who as a chief founder of the Conference was deservedly eulogised for his invaluable services ; sincere sympathy being expressed in a resolution to him with a wish for his speedy recovery.

The most popular people's man, the Hon. R. E. Brassington, M.C.P., Mr. R. Montgomery Parker and Hon. Prof. J. B. Harrison could not attend the Conference owing to unforeseen circumstances but their earned admiration was intense.

Iirrgation and Drainage Scheme was the slogan of the Conference.

This recurrent and burning question received its fair quota of consideration. If anything more than another is needed to further agricultural interests in our "Magnificent Province" it is Irrigation and Drainage, which should be a Colonial question for the ultimate establishment of a thriving peasantry.

It does not need my pen to describe the devastation and ruin as well as the discouragement to farmers consequent on the annual inundations and droughts.

It would be well if the Planters' Association could join forces with the Government and cause "Irrigation and Drainage" to enter soon into the realm of practicability. This colony needs more than four times its present population as it needs badly "Irrigation and Drainage," more factories and other openings of employment which are concomitants of a prosperous Government and a thriving peasantry.

The Hon. J. S. McArthur, M.C.P. and Mr. J. A. Luckhoo, F.R., honoured themselves and encouraged the Conference with their presence.

The ubiquitous Editor-manager of the Daily Chronicle, too, took active part at the Conference.

The British Guiana Teachers' Association was represented by Messrs. H. D. Durant and H. Bunyan, President and Vice-President, respectively.

A great impression made by the Conference was that it had justified its existence and had accomplished much. On the whole, the questions and motions were timely, showing the great interest farmers had taken in Agriculture, which is a happy innovation.

The Education Department, the Department of Science and Agriculture, the Government, orginators of Agricultural shows in this Colony, the Schoolmasters, who readily took the first Agricultural lectures and passed examinations, years ago, must have had jubilant reminiscences as their dreams and visions, etc., are now realities.

Let everyone, therefore, be inspired with greater faith, refusing to be in the class of pessimists. In the near or distant future our native country I believe will bloom forth greater things.

Attracted "Labour and More Money ;" Brains and General Prosperity would fraternise with one another.

Then the exodus of some of the people would give "the right of way" to free immigration automatically and the name, "Magnificent Province" would not be a misnomer.

The Conference was both educative and interesting. It is destined to be a more powerful factor under the aegis of the Government for the fostering of Agriculture in an Agricultural Colony. It is suicidal, therefore for any self-respecting farmer and patriot, at this stage, to withhold his or her connexion from the Conference.

Rural pedagogues formed a prominent part in the Conference which augurs much for further success.

Conspicuous among the visitors were the Rev. H. W. Grant and Persaud, ministers of religion. All ministers of religion should be in some form or other interested in Colonial Agriculture.

Mr. H. Aaron Britton, who is also one of the principal founders of the Conference and well-known for his ability, is now elevated to the presidency of it. We

believe that with his mature experience and with the co-operation of the Conference Mr. Britton ought to do something more during his regime.

The Rev. Carlyle Miller of Victoria, East Coast, Demerara, read a very good "Conference Paper" entitled "The Signs of the Times."

Beterverwagting cane farmers and others must be congratulated for their clean village and for their hospitality. The unity and the good training of the schoolmasters at Beterverwagting must be commended.

It was unanimously decided that the next Conference be held at Hague, West Coast, Demerara.

Although unequal to the task I have obeyed the order to write, at the shortest possible notice, my impressions of the Conference.

THE BRITISH GUIANA FARMERS' CONFERENCE.

By R. Reuben Baird.

The Sixth Annual Conference of the British Guiana Associated District Agricultural Societies, held at Beterverwagting Village, on the 5th and 6th April, 1921, is now an event of the past. Unlike other events of the kind, however, and to this all the leading organs of thought seem to ungrudgingly subscribe—it would not end in smoke, but rather would make its influence felt not only in the development of the civil, economic and industrial stability of the Colony of to-day, but also that of to-morrow.

As one writes, one begs the memory to recall instances in which men recruited principally from the masses of the people of this colony, met, and almost with sacred ardour, evinced such grim determination and keenness in, and discussed with such foresight, unselfishness and statesmanship, questions affecting the colony as a whole.

There were debates; there were speeches; there were papers; there were reports; but all seemed to have relegated to the inglorious past, the gloss, the embellishments, which, at one and at the same time won applauses, but failed to make impressions; and to have served up, unceremoniously, the bald facts, the undressed conditions, such as they exist in our communal life. In short, business definiteness, something concrete, something achieved seemed to have dominated, seemed to have sufficed the being of every delegate. If the motions, if the debates, coupled with the Spirit of the delegates must be regarded—and there is no reason to think otherwise—as indicative of the feeling of the farmers all over the colony, then it cannot but be taken for granted that they are realising the power of combination, they are feeling the want of, and are appreciating the necessity for more organised agricultural education; they are learning the Gospel of Self-help; they are becoming more conscious of the fact that if the agricultural resources of this colony must be developed, if an independent peasant proprietary must be a reality, if this colony must function in Imperial interests, then they must depend not only upon the Government, but also, and more so upon themselves.

Held at a time when the staple industries of the colony are passing through perilous times, when the question of Drainage and Irrigation seem to be the Slogan of the day; when the General Election is drawing near, it was necessary for this Conferenee to make its contribution to these great issues. Little wonder then, that due prominence was given to them.

The question of Cane-farming was discussed in all its phases. The Farmers' cards will, in due course, be laid on the table by those appointed so to do. But in passing, one is inclined to say that it seems as if the Planters will have a case to answer.

While *sympathy* was given to those who had suffered as a result of the present regulations concerning the exportation of rice, something tangible, something concrete

was held out to those who had suffered as a result of lack of an irrigation scheme. Almost unanimous was the opinion that nothing but increased production during the current year could justify exportation, and to that end was the co-operation of all enlisted. But is it not time that increased production is dependent upon IRRIGATION not to speak of DRAINAGE ? Great, therefore, was the emphasis laid upon this all-important question.

With guarded care were the slippery paths of Politics eschewed. Every flame fanned in that direction was quickly smothered. Yet, it was none the less evident that there was the veiled suggestion that it is the intention of the Conference to manifest more than ordinary interest in the forthcoming Election.

The interest manifested by all classes of the community calls for more than passing notice. A brilliant array of young men lent lustre to the proceedings, and the opinion was unhesitatingly expressed that there is still a bright future for Agriculture.

From all that one was privileged to observe one was compelled to concede that this Organisation is truly the farmers' mouthpiece, and whatever is said and done it must be admitted that from its inception it has been functioning in the interests of farmers, and that it is destined to play an important part in the development of this colony.

The office-bearers for the current year are chiefly young men and coupled with this, a new spirit, a progressive policy has been evinced, has been mapped out, there is, therefore every hope for a successful year, for a future productive of results for the general good.

SOME INSECT PESTS OF BRITISH GUIANA.

By G. E. Bodkin, B.A., Dipl. Agric (Cantab), F.Z.S., F.E.S.,

Assistant Director and Government Economic Biologist, Department of Science and Agriculture, British Guiana.

(The paper read by British Guiana's Official delegate to the Imperial Entomological Conference in London, June, 1920.)

British Guiana is the sole British possession in the whole, vast South American Continent and has an area of 90,000 square miles, or, is approximately, the size of Great Britain. It has a population of some 300,000 people.

It is divided, roughly into 3 belts; the coastal region is flat—practically a belt of marine alluvium ; then a belt of slightly more elevated country consisting of sandy and clayey soils and finally the immense forest areas containing mountain ranges. The eastern portion of this is almost entirely forest clad, but on the north western side there is an extensive area of flat, grass-clad, savannah-land some 300 feet above sea level.

There is a mean annual rainfall of some 94 inches and the average, mean shade temperature is somewhere round 80 degrees F.

As British Guiana's principal agricultural product is sugar, I propose to confine what I have to say mostly to the insect pests of sugar cane and the local methods of control.

There are in the colony to-day, some 36 sugar estates in active operation producing annually some 114,000 tons of sugar, 3,416,000 gallons of spirits and rum, 150,000 gallons of molasses and 2,400 tons of molascuit, the well known cattle food.

Given an adequate labour supply these returns could be vastly augmented.

Insect pests of sugar-cane have been recognized in British Guiana for at least the last quarter of a century, but it is only during more recent years that they have received any serious attention or combined efforts been made for their control.

To-day the injury and financial losses caused by such insects is fully realized, and the control of insect pests on a sugar estate in British Guiana is now a regular part of the routine.

Owing to the somewhat peculiar conditions of cropping which are closely connected with the marketing of the product, cane at various stages of growth is to be found throughout the year, there being no recognised regular harvest. This renders the control of pests a particularly difficult matter, for as one area is cut these insects simply migrate to another adjoining area in a younger stage of growth.

The most injurious pests are those known collectively as "borers," which consists of three species of lepidopterous larvae, namely, *Castnia licus*, Fab., a member of the exotic family Castniiadae, which is popularly called the giant moth borer, *Diatraea saccharalis*, F., a member of the Pyralidae, and well known in most sugar-growing areas of the world, which is termed locally the small moth borer, and *D. canella*, Hamps., which is much like *D. saccharalis* in all its stages.

These three pests pass their larval and pupal periods within the cane itself, thus weakening it and causing a material deterioration in the juice. Their attacks are often followed by a complete destruction by Termites or wood ants, whose function in the insect world is to entirely demolish all decaying or diseased vegetable matter.

The Giant Moth Borer.

The giant moth borer confines its attack more to the stool or rooting system of the cane. It is a comparatively

years ago. Since its first appearance it has multiplied at an exceedingly rapid rate, and during 1919 on 16 estates 91,479 moths were destroyed and 1,600,046 larvae.

Like many of the injurious insects in this part of Tropical America, Castnia has invaded the cultivated areas from the forest region, the original habitat of its larva being either orchids or the roots of wild plantains. It will also breed in the roots of cultivated plantains and bananas. The larva attains a length of 2 to 2½ in. No known true parasites of this pest have ever been discovered, This is due to the concealed habit of the larva and chrysalis; which is often some considerable distance beneath the surface of the soil, and the eggs are deposited in the most haphazard manner by the female moth, never being laid in any particular spot, but dropped one or two at a time about the cane plants. This, of course, excludes the possibility of egg parasites. Birds are the most important enemies of Castnia, especially the so-called kiskadee (*Pitangus sulphuratus*) and the old witch (*Crotophaga ani,*) both of which are particularly fond of the adult moth. On all sugar estates organized gangs, principally composed of native-born East Indian children (known as Creoles), are employed in the destruction of this pest. The gangs vary in size from thirty to as many as 100 individuals on some estates. These children have grown remarkably astute at this work, and many of them now earn comparatively large sums of money.

The most effective control method employed is to send a gang of these children through a field of canes that has recently been cut. They search the roots of the cane for traces of the borer, and wherever frass or an open boring is observed in the stumps a long hooked wire is introduced therein, and after some manipulation the larva, if present, is impaled and dragged to the surface. If this is not successful, the stump is partially dug up and the larva, or chrysalis thus secured. This method gives excellent results The caterpillars and chrysalides are kept by each individual in an old tobacco tin, and at the end of the day the contents are arefully counted and checked. A half-penny apiece

is paid for the caterpillars or chrysalides when they are scarce, but the price fluctuates. Boys provided with nets are also employed to catch the adult moths. A higher price is paid for the moths, which only fly during certain parts of the day.

The Small Moth Borer.

The small moth borer has been known in the cane fields for many years, and much has been written concerning its life-history and habits. This small insect has received considerable attention in Louisiana, where it has become a serious pest. It is capable of completing its life-history in other plants than cane, such as several species of grasses and Indian corn.

It confines its attacks more to the cane itself, and more especially during the first three months of the plant's existence.

The eggs are deposited by the female moth on the young leaves as soon as they appear, and the resulting larva bores its way gradually down into the centre of the plant, thus destroying the growing point and causing the central shoot to wither and die.

Older canes, especially those with a hard epidermis, are not so frequently attacked owing to the difficulty of gaining an entrance to the cane.

This pest is principally destroyed by the method popularly known as cutting out.

Gangs of East Indian children are sent through the fields of young cane, and wherever a dead central shoot is observed it is cut off close to the ground, split open, and the contained larva or chrysalis secured and placed in a tin. A fair price per hundred is generally paid for the grubs and chrysalides, though this price, of course, fluctuates according to the abundance of the pest. Three hundred are sometimes collected by one individual during the day. Cutting out cannot be employed after the canes are four months of age.

During 1919, 22,779,354 caterpillars and chrysalides were thus destroyed, The collection of the egg masses of

this pest is now performed on most estates. The eggs are light yellow in colour, oval in shape, and are deposited overlapping one another in the mass. Though somewhat difficult to discern at first, with practice it is possible to collect quite a fair number during the course of the day. A small gang of specially trained children are employed in the work, and are well paid.

Two species of egg parasites of the small moth borer are commonly met with, and one *Trichogramma minutum.* Riley, has a world-wide reputation, as it is known to parasitize the ova of many species of Lepidoptera in many parts of the world.

Several species of external Hymenopterous parasites occur, one Dipterous parasite, and a fungus parasite, a species of *Cordyceps.* The larva of an Elaterid beetle also preys on the early stages.

These parasites, especially the egg parasites. perform excellent work in the control of this pest, and lines of work have recently been commenced with a view to increasing, if possible, their utility:

Other Pests.

Other more important pests include the so-called weevil borer (*Metamasius hemipterus,*) which at times damages the stools and rooting system of the cane.

The larvae of two Noctuid moths, *Remigia repanda* and *Laphygma frugiperda,* feed on the leaf-blades of the cane, and at times occur in enormous numbers, stripping whole fields of their foliage, and leaving nothing but the hard midribs. These are destroyed by collecting the caterpillars in buckets containing paraffin and water. They become most numerous on the advent of rains after prolonged drought.

Two species of Termites occur frequently, and their characteristically constructed nests may be seen in parts of the fields. They destroy all canes which have been previously weakened by borer attacks, the tunnel of the borer often serving as an entrance. They will at times attack a healthy cane, though this seldom occurs. These

pests regularly receive attention, and the weeding gangs on all estates have orders to remove every nest which they meet with. These are collected in sacks, taken out of the field, and burnt.

A species of mealy bug occurs at times in large numbers beneath the sheathing base of the leaf. When large numbers are present they undoubtedly weaken the vitality of the cane. These insects are destroyed in damp weather by fungus. In dry weather they multiply rapidly and remain healthy.

Two species of Cercopidae, known throughout the West Indies as frog-hoppers, occur at times in small numbers, but their damage is generally speaking negligible. Owing to the clean weeding invariably indulged in, the numbers of these pests never become a menace to the industry as they have in Trinidad.

These notes cannot be terminated without some reference to the excellent control work carried on by most of the sugar estates through the instrumentality of their managers. Although the pests have by no means yet been controlled, combined efforts are being put forth to this end, involving considerable inconvenience and expense to each estate. Efforts such as these on the part of the practical man are exceedingly encouraging, and serve as an example to agriculturists in other parts of the world, who at times are inclined to consider economic entomology more in the light of an interesting hobby than a serious practice which will very handsomely repay the necessary initial expenditure.

Coconuts.

Latterly the cultivation of the coconut palm has received considerable attention and large areas have been planted up in various parts of the colony.

Its chief insect enemy is the larvae of a butterfly known as *Brassolis sophorae*, L. This pest at times defoliates nearly every palm in a district.

The larvae are very distinctly gregarious and live in large nests which they construct themselves by drawing

together a number of leaves of the palm. Such a nest may contain close on a hundred larvæ.

These caterpillars feed exclusively at night. Their nests are conspicuous objects and it is an easy matter to send a boy up an infested palm and cut down the nests. Unfortunately it has been found necessary to enforce legislation so as to control this pest as many of the native cultivators refuse to regard the control thereof seriously.

An immense species of locust in one particular area has recently developed a taste for the foliage of the coconut palm and from time to time does a lot of damage.

Locust Invasion.

In 1917 we experienced an invasion of the South American imigratory locust from Venezuela.

After a strenuous fight of 5 months we were successful in eliminating the swarm and its progeny.

Legislation had to be carried out in some parts of the colony, however, and proved enormously effective especially against the gentleman who suddenly developed acute religious tendencies and declared that "as the Lord had sent these insects he would just as assuredly remove them again." The cost of this campaign was under £500 as against some £4,000 expended by the Government on a previous occasion before there was an Entomological Division attached to the Agricultural Department.

Minor Pests.

Other crops such as rice, citrus, coffee and cacao are not damaged to any extent by insect pests. This is particularly the case with rice. When the plant is in the nurseries, prior to be planting out, the larvæ of the Noctuid Moth *Remigia Repanda* often cause injury by feeding on the young green shoots. By flooding these nurseries the caterpillars can easily be got rid of. The small moth borer of sugar cane frequently attacks the grown plant.

Scale insects at times prove troublesome to citrus plants such as oranges and limes—especially limes. Cacao is more prone to fungoid diseases.

Time does not allow of an account of the pests which attack man and animals. A full description of such appeared in the publications of the Bureau of Entomology a few years ago. The ever increasing parts which such creatures are found to take in the destinies of human affairs point to their closer study in the future.

Lantern Slides.

Twenty-five slides from the author's own negatives were shown at the conclusion of the paper. Seventeen of them pictured phases of insect control on sugar estates. The rest were incidents relative to the destruction of insect pests in the Colony.

Owing to pressure of space we have been obliged to hold over till the next number, the second and final instalment of the proceedings of this Conference.—Editor.

COLONY BIRDS IN RELATION TO AGRICULTURE.

No. 2—Old Witch.—(*Crotophaga Ani.*)

By F. Stell, Assistant Government Botanist and Mycologist.

Of the several hundred species of birds found in the Colony, probably none are more familiar to the average person than the birds called locally—" old witches." They belong to the cuckoo group of birds, and the subject of the present note is by far the commonest species.

The old-witch is a comparatively large bird. Its length is about twelve inches and it is fairly plump. Some of its features are very prominent. The most pronounced characteristic is the keel-like crest on the upper part of the beak. This crest extends from the base to the tip of the bill.

The plumage is a deep black with violet-blue reflections A closer examination of the bird shows that the

feet are zygodactyle, *i.e.*, two toes are directed forwards and two backwards. The old witch has a weird distinctive appearance. Its habits, also, are peculiar. The outstanding feature is its social or gregarious mode of life. Along the road-sides, in the suburbs, and in various cultivations, one often encounters a dozen or twenty of these birds. They are very confiding. Whether this is absence of fear or the feeble power of flight possessed by the bird, it is difficult to say. Anyway, this species of cuckoo has a very clumsy, slow, and laboured flight, and only covers short distances. Unlike the European cuckoo, the "old-witch" does not derive its name from its call-note. The cry of the colony cuckoo is loud and harsh, a sort of scream, and not at all pleasing.

A unique quality of the gregarious habit is carried to an extreme point in the case of the " old witch ;" most birds live more or less socially at some stage of their life; it may be as nestlings, or in foraging parties, or in defending themselves against an enemy. Further, many birds adopt a colony habit for nesting purposes. But with the old-witch, the social habit of nesting is pushed to the extreme. One actually finds several birds making use of the same nest, and ten or a dozen eggs are quite frequently deposited in the same nest. This nest is an ugly, untidy structure, made of dry sticks and generally located in dense pimpler bushes. The freshly laid eggs have a coating of a powdery, calcareous nature; beneath this—which is readily removed—the colour of the eggs is a bright blue.

Like most organisms, the old-witch has to eat to live. What does it eat? Is its food such as to make it a friend or a foe of the agriculturalist? Does it do more good than harm, or *vice versa*? These are questions of practical importance and an accurate answer can only be declared from an analysis of stomach contents. However, caterpillars and insects generally are known to be consumed in large numbers by the cuckoo group of birds, though no doubt, some fruits are sampled and found satisfactory. The point to decide is: what is the balance of evidence; is it for or against the " old witch " ? To this end, information from farmers and planters is solicited.

EXPORTS OF AGRICULTURAL AND FOREST PRODUCTS.

Below will be found a list of the Agricultural and Forest Products of the Colony exported during the first quarter of 1921. The corresponding figures for the two previous and the average for the four years previous to that are added for convenience of comparison.

Product.	*Average 1915-18.*	*1919.*	*1920.*	*1921.*
Sugar, tons ...	25,165	22,180	19,449	67,864
Rum, gallons	1,243,019	1,865,365	669,845	955,138
Molasses, gallons	1,900	164,113	None	None
Cattle-food, (Molascuit) tons	556	435	260	846
Cacao, cwts. ...	66	None	8	None
Citrate of Lime, cwts.	19	5	44	19
Lime Juice, gals.	1,105	None	None	No Records available
Essential Oil of Limes, gals.	8	5	None	
Coconuts, thousands	508	1,456	1,615	716
Copra, cwts. ...	607	762	None	330
Coffee, cwts. ...	891	5,751	989	299
Kola-nuts, cwts. ...	83	None	10	None
Rice, tons ...	4,589	638	5,519	None
Ricemeal, tons ...	70	None	None	None
Cattle, head ...	201	None	None	None
Hides, No. ...	791	2,291	2,265	839
Pigs, No. ...	226	None	None	None
Sheep, head ...	10	None	None	None
Balata, cwts. ...	2,614	2,004	1,786	3,139
Charcoal, bags ...	12,265	11,941	13,689	11,375
Firewood, Wallaba, etc., tons	2,743	231	1,063	1,732
Gums, lbs. ...	248	None	2,861	7,055
Lumber, cub. ft. ...	58,584	59,508	40,754	15,706
Railway sleepers, No.	3,627	1,308	3,310	2,614
Rubber, cwts. ...	240	42	100	726
Shingles, thousands	510	747	372	242
Timber, cub. ft. ...	28,445	8,137	14,689	41,567
Coconut Oil, gals....	6,557	11,941	13,689	6,209

ATTENDANCES AT THE DISTRICT GARDENS

Year.	Bourda.	Belfield, E. Coast.	Stanleytown, New Amsterdam.	Suddie, Essequibo.	Den Amstel.	Houston, E. Bank.	Wakenaam.	Total Attendances.
1912 ...	5,514	4,395	3,302	2,100	2,544	2,156	718	21,729
1913 ...	5,156	4,535	2,519	3,399	2,568	1,836	1,319	21,332
1914 ...	4,243	3,869	2,443	3,025	1,791	1,653	1,533	18,577
1915 ...	1,123	1,006	769	59	503	339	401	4,200
1916 ...	4,705	1,161	1,510	225	623	2,251	1,297	12,026
1917 ...	4,991	2,820	1,366	3,297	1,186	2,564	1,663	17,886
1918	4,834	3,081	1,653	2,671	2,162	2,790	2,067	19,258
1919	4,769	2,425	1,582	2,798	1,851	2,480	1,556	17,461
1920	6,285	2,312	1,665	2,525	2,532	3,228	2,148	20,695
1921								
1st Quarter	1,761	639	502	307	673	829	490	5,201

Meteorological Data—Jan. to March, 1921.

Months	Rainfall.	NUMBER OF DAYS OF RAIN						Evaporation.	Air Temperature and Humidity.			
									Air Temp.			Humidity
Botanic Gardens.	Total Inches.	Under ·10 Inches	·10 to ·50 Inches	·50 to 1.00 Inches.	1.00 to 2.00 Inches	Above 2.00 Inches	Total days	Inches	Maximum	Minimum	Mean	Mean
Jan. ...	4.81	9	7	2	1	...	19	4.35	83.7	74.9	79.3	78.6
Feb. ...	.48	...	3	...	...	...	03	5.30	84.6	74.7	79.6	73.1
March ...	3.45	5	10	1	...	...	16	5.71	85.0	75.0	80.0	78.5
Totals & Means.	8.74	14	20	3	1	...	38	15.36	84.4	74.8	79.6	76.7
Berbice Gardens												
Jan. ...	5.20	3	8	2	1	...	14	...	91.8	75.2	83.5	77.9
Feb. ...	1.92	2	3	...	1	...	6	...	89.3	75.0	82.1	71.5
March ...	1.45	2	4	1	...	...	7	...	87.0	74.9	80.9	74.6
Totals & Means.	8.57	7	15	3	2	...	27	...	89.3	75.0	82 2	74.6
Onderneeming.												
Jan. ...	4.72	...	8	3	1	...	12	...	87.6	72.8	80.2	...
Feb. ..	.30	1	2	...	...	...	3	...	87.0	72.7	79.8	...
March ...	2.41	5	9	1	...	...	15	...	87.6	72.5	80.0	...
Totals & Means.	7.43	6	19	4	1	...	30	...	87.4	72.6	80.0	...
Mora-whanna												
Jan. ...	10.06	7	8	4	2	1	22	...	...	...	...	...
Feb. ...	6.43	3	7	2	...	1	13	...	...	...	...	...
March ...	6.59	3	15	3	...	...	21	...	...	...	...	...
Totals ...	23.08	13	30	9	2	2	56	...	...	...	...	...